

REMARKS

The Official Action rejected all of the claims under 35 U.S.C. § 103(a). In this regard, the Official Action rejected Claims 1-8, 10, 11 and 14-18 as being obvious over U.S. Patent No. 5,513,537 to John R. Brooks, et al. in view of U.S. Patent No. 4,415,811 to Jurgen Beck, et al. Additionally, the Official Action rejected Claim 9 as being obvious over the Brooks '537 patent in view of the Beck '811 patent and further in view of U.S. Patent No. 5,359,525 to Steven Weyenberg, and Claims 12 and 13 as being obvious over the Brooks '537 patent in view of the Beck '811 patent and further in view of U.S. Patent No. 6,295,129 to Svante Bjork. Further, the Official Action rejected Claims 19-41 for generally the same reasons as set forth in conjunction with prior similar claims. As described in detail below, independent Claims 1, 19 and 35 have been amended to further patentably distinguish the claimed invention from the cited references, taken either individually or in combination. In light of the amendments to the independent claims, dependent Claims 11 and 29 have been cancelled. Based upon the forgoing amendments and the following remarks, Applicants respectfully request reconsideration of the present application and allowance of the amended set of claims.

The system for identifying defects in a composite structure during fabrication of the composite structure is defined by amended independent Claims 1 and 19 to include a camera for receiving images of the composite structure having a layer comprised of a plurality of adjacent composite strips. As now recited, the plurality of adjacent composite strips are positioned in a common direction. The system of independent Claim 1 includes a processor for processing the images and outputting a response identifying a defect based on the images, while the system of independent Claim 19 recites a memory device for storing the images. The system of independent Claims 1 and 19 each also include a light source positioned at an oblique angle relative to the composite structure for illuminating the composite structure. The light source has an infrared component that is differently reflected by defects in the composite structure than from portions of the composite structure that are defect free. As now amended, the light source is positioned so as to illuminate the composite structure in a direction substantially perpendicular to the common direction of the composite strips.

Similarly, the method of identifying defects in the composite structure during fabrication of the composite structure that is set forth by independent Claim 35 initially positions a camera proximate the composite structure, wherein the composite structure has a layer that is formed from a plurality of adjacent composite strips positioned in a common direction. The composite structure is illuminated with an obliquely-mounted light source having an infrared component with the illumination now being recited to be in a direction substantially perpendicular to the common direction of the composite strips. The camera and the light source are moved across a composite structure and the images of the composite structure recorded. The images may then be processed to identify defects in the composite structure.

Applicants initially submit that the Brooks '537 patent and the Beck '811 patent cannot properly be combined in an attempt to obviate the claimed invention. In this regard, the Brooks '537 patent is directed to a method and apparatus for determining the tack of a composite prepreg and determining if that tack is within an appropriate range so as to adhere the composite prepreg to a substrate when joined under predetermined conditions. In determining the tack, the method and apparatus of the Brooks '537 patent rely upon reflected light from the adhesive contact area. In contrast, the Beck '811 patent describes an optical scanning apparatus that relies upon light transmitted past an object under evaluation to identify defects in the object. In this regard, a properly formed object with no defects would not allow any light to pass by the object and be collected by the solar cell, while an improperly formed object and/or an object with defects would allow at least some of the light to pass by the object and be collected by the solar cell. Since the method and apparatus of the Brooks '537 patent is dependent upon the reflectance of light to determine the appropriateness of the tack of a composite prepreg and the optical scanning apparatus of the Beck '811 patent is dependent upon the transmittance of light past an object under investigation, Applicants submit that one of ordinary skill in the art would lack the requisite motivation or suggestion to combine the references since they are directed to techniques for solving different problems (e.g., the measurement of tack by the method and apparatus of the Brooks '537 patent and the identification of defects in an object by the optical scanning apparatus of the Beck '811 patent) and since they rely upon different modes of operation, that is

reflectance in the method and apparatus of the Brooks '537 patent and transmittance in the optical scanning apparatus of the Beck '811 patent.

Even if they were combined, no combination of the cited references teaches or suggests systems or methods for identifying defects based upon the differential reflections of light, as recited by the claimed invention. In this regard, the Brooks '537 patent is not directed to the identification of defects as suggested by the Official Action. Instead, the Brooks '537 patent describes a method and apparatus for determining if a composite prepreg has sufficient tack so as to adhere to a substrate under predetermined conditions. Thus, the method and apparatus of the Brooks '537 patent evaluate the adhesive contact between a composite prepreg and a substrate and does not attempt to identify defects, such as gaps between adjacent composite strips as in the claimed invention. While the Beck '811 patent does attempt to identify a defect in an object, the identification is not based upon reflection of light, but instead is based upon light that is transmitted by or through the object under evaluation, as described above. Further, the tertiary references, that is, the Weyenburg '525 patent and the Bjork '129 patent, similarly fail to teach or suggest the reflectance of light to identify defects in a composite structure as recited by the claimed invention. Thus, since all of the cited references fail to teach or suggest a system or method that relies upon the reflection of light to detect defects in composite structures as recited by amended independent Claims 1, 19 and 35, Applicants submit that any combination of the references would likewise fail to teach or suggest the claimed invention.

As now recited, the system of amended independent Claims 1 and 19 and the method of amended independent Claim 35 are further patentably distinct from the cited references, taken either individually or in combination, since independent Claims 1 and 19 now recite that the light source is positioned so as to illuminate the composite structure in a direction substantially perpendicular to the common direction in which the plurality of adjacent composite strips are positioned and similarly since the method of amended independent Claim 35 recites that the composite structure is illuminated in a direction substantially perpendicular to the common direction in which the plurality of adjacent composite strips are positioned. None of the cited references teach or suggest the fabrication of a composite structure from a plurality of adjacent

composite strips, let alone a plurality of adjacent composite strips positioned in a common direction so as to form a layer as now recited by the amended independent claims. While the Brooks '537 patent does discuss the fabrication of the composite structure, the composite prepregs are laid one upon another and are not positioned adjacent one another so as to extend in a common direction and to form a layer of the composite structure as now recited by amended independent Claims 1, 19 and 35. As such, the light source described by the Brooks '537 patent is not positioned so as to illuminate the composite prepreg in a direction substantially perpendicular to the common direction of the composite strips. Instead, the light source of the Brooks '537 patent appears to illuminate a generally square adhesive contact region. Similarly, the other cited references fail to teach or suggest a composite structure having a layer formed of a plurality of adjacent composite strips positioned in a common direction and further fail to teach or suggest a light source positioned so as to illuminate the composite structure in a direction substantially perpendicular to the common direction of the composite structure, as now recited by amended independent Claims 1, 19 and 35.

The positioning of the light source so as to illuminate the composite structure in a direction substantially perpendicular to the common direction of the composite strips is not only counterintuitive, but has proven to be quite advantageous. In this regard, as set forth by the present application on page 9, lines 11-23:

It has been observed that the composite structure **14** produces high glare when illuminated obliquely across the direction of placement of strips **16**, while producing substantially less glare when illuminated obliquely along the direction of placement of the strips. While conventional systems sought to eliminate the glare, the systems and methods of the present invention seek to exploit the glare. In particular, the systems and methods of the present invention exploit the high-glare/low-glare phenomenon by casting oblique light across the top layer of composite strips in a direction substantially perpendicular to the direction of placement of the strips, which produces a relatively large amount of glare on the top layer. The underlying layers, which produce significantly less glare than the top layer because of their orientation, will show through any gaps or other defects in the top layer and thus be easily located. In addition, twists and other surface defects in the top layer will alter the orientation of the strips in the top layer and thus the glare of the top layer at the defect location.

For each of the foregoing reasons, the cited references, taken either individually or in combination, fail to teach or suggest the system and method of amended independent Claims 1, 19 and 35. Since the dependant claims include at least the recitations of a respective independent claim, the dependant claims are likewise not taught or suggested by the cited references for the reasons described above. However, a number of the dependant claims include additional recitations that further patentably distinguish the dependant claims from the cited references.

In this regard, dependent Claims 10 and 28 recite that the oblique angle at which the light source illuminates the composite structure is about 45 degrees. The Official Action notes that the Brooks '537 patent indicates that the light source can illuminate the adhesive contact area at an angle of about 25 degrees, but is adjusted to get the best illumination of the specimen. Since the method and apparatus of the Brooks '537 patent is directed to the analysis of the adhesion of a composite prepreg to a substrate, the angle that would be best to use for the light source disclosed by the Brooks '537 patent may not have any relation to the angle that is best used by the system and method of a claimed invention to identify defects in a composite structure. Thus, Applicants submit that the disclosure by the Brooks '537 patent does not teach or suggest positioning of the light source so as to illuminate the composite structure at an oblique angle of 45 degrees as recited by dependant Claims 10 and 28.

Further, the Official Action appears to impermissibly rely upon hindsight in reaching its conclusion that it would be obvious to position a camera and the light source proximate the compaction roller as recited by dependant Claims 17 and 33 and, more particularly, on the head unit as recited by dependant Claims 18 and 34 since none of the cited references teach or suggest any such positioning. If the Office persists in maintaining the rejection of these dependant Claims, Applicants respectfully request that a reference be identified in support of the proposition that it would have been obvious to one of ordinary skill in the art to have positioned a camera and the light source as recited by these dependent claims.


For each of the foregoing reasons, Applicants submit that the rejections of the claims under 35 U.S.C. § 103 are therefor overcome.

CONCLUSION

In light of the amendments to the claims and the foregoing remarks, Applicants submit that the amended set of claims is in condition for immediate allowance. The issuance of a Notice of Allowance is therefore respectfully requested. In order to expedite examination of the present application, Applicants request that the Examiner contact Applicants' undersigned representative to address any remaining issues.

It is not believed that extensions of time or fees for net addition of claims are required, beyond those that may otherwise be provided for in documents accompanying this paper. However, in the event that additional extensions of time are necessary to allow consideration of this paper, such extensions are hereby petitioned under 37 CFR § 1.136(a), and any fee required therefore (including fees for net addition of claims) is hereby authorized to be charged to Deposit Account No. 16-0605.

Respectfully submitted,




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